canusa Newsletter

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Spruce Budworms
Program

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The Western Spruce Budworm in The American Rocky Mountains

Infestations of the western spruce budworm, *Choristoneura occidentalis* Freeman, have been recorded in the American Rocky Mountains for the past 60 years in the area shown in Figure 1.

Outbreak Histories

The western spruce budworm was first reported in the Northern Region[1] in the early 1920's. Only scattered and insignificant infestations were reported from time to time for the next 30 years, although outbreaks occurred over large areas in two northern Idaho National Forests to the early 1930's, and small outbreaks persisted until the early 1950's on one or two Ranger Districts east of the Continental Divide in western Montana.

The first significant outbreak in the Northern Region began about 1948, reached two million acres by 1952, and has persisted until now, fluctuating between two and four million acres infested per year. The gross infested acreage during the 30-year period exceeds ten million acres.

In the Intermountain Region[1], outbreaks occurred almost annually on the Boise and Payette National Forests from the early 1920's to early 1930's, and less frequently on other forests during this period. No significant outbreaks were reported anywhere in this Region from the early 1930's until about 1950, but have been continuous in one forest or another since that time. Annual infested acreages have generally fluctuated from about 1/2 million acres to about 1 1/2 million acres, except in 1964 when 2 1/4 million acres were infested.

The major western budworm outbreaks in the Rocky Mountain Region[1] have been at scattered locations in the Colorado front range, with outbreaks peaking in 1933, 1947, 1962, and 1978. Budworm activity in other areas of Colorado and Wyoming, particularly in recent years, has been scattered and restricted to a few thousand acres of light to moderate defoliation.

In the Southwestern Region[1], budworm activity prior to 1950 was scattered or nonexistent. Since that time the budworm has persisted in all areas of the Region where extensive stands of Douglas-fir and true firs occur, particularly the north central forests in both New Mexico and Arizona. Budworm outbreaks have fluctuated in this Region from lows of 20,000 acres to peak years of more than 3/4 million acres infested.

[1] Administrative Regions of USDA Forest Service:

Northern	— Montana, northern Idaho, North Dakota and northwestern South Dakota.
Intermountain	— Utah, southern Idaho, western Wyoming and Nevada
Rocky Mountain	— Colorado, Kansas, Nebraska, South Dakota and eastern Wyoming.
Southwestern	— Arizona and New Mexico.

Figure 1. Area in which outbreaks of the western spruce budworm are known to occur in the American Rocky Mountains.

Two features of Rocky Mountain forests are significant in western spruce budworm management. One is ownership — nearly 75 percent of the forest land is federally-owned, but the remainder is state or privately-owned. The second feature is that the majority of budworm-infested forests in the Rocky Mountains are scattered and discontinuous, characteristically separated from one another by wide expanses of nonforested land.

In the Rockies, western spruce budworm outbreaks occur in a variety of ecological situations — in pure and mixed stands, in several forest series and in most habitat types, and over topographic, physiographic, and elevational gradients. In spite of this diversity, or perhaps because of it, most forests in the Rocky Mountains appear to be susceptible to outbreaks.

Damage and Impact

Host tree species most heavily damaged are: Douglas-fir, grand fir, white fir, subalpine fir, Engelmann spruce, and western larch. Host tree vulnerability is related to its shade tolerance. For example, in mixed stands of grand fir and Douglas-fir, the more tolerant grand fir nearly always is more seriously defoliated or top-killed.

In most species, the greatest damage from the budworm is: 1) reduction in height and radial growth, and top-killing and tree-killing in regeneration, sapling, and some pole-sized stands; 2) growth reduction and top-killing in older growth stands; and 3) damage to cones and seeds. Current investigations in the Intermountain Region are showing considerable volume losses in grand fir due to decay that develops in previously top-killed, forked, or multiple-topped trees.

Probably the most serious resource management impact is regeneration failure. This may be brought about by a combination of three closely-related types of damage: 1) severe defoliation or top-killing that influences the production of cones; 2) larval feeding on cones and seeds that causes drastic reductions in seed production; and 3) defoliation and mortality of seedlings.

A recent study in the Northern Region indicates that defoliation-induced growth reduction and top-killing are most severe on the better sites. For example, growth reduction was 5.3, 1.5 and 0.2 cubic feet per acre per year on better (moist), intermediate and poor (dry) sites, respectively. Top killing was 88, 78 and 12 trees per acre, respectively, on the same sites. These data may be influenced by species mixtures; there is a higher incidence of the true firs on the better sites and Douglas-fir is the predominant species on the poorer sites. In Douglas-fir forests, trees are most severely damaged on the drier, more shallow-soiled sites, primarily east of the Continental Divide.

In some areas in the Rockies, the most serious impacts are on aesthetic values.

Biology

There are several biological differences between the western spruce budworm and the spruce budworm in the East. Dispersal and feeding of stage II larvae extends about one month later to late June, stage VI larvae are present about one month longer to mid-July, and the moth flight extends to late August. The egg complement of female moths is about 150 eggs (compared to 200) but egg masses are usually larger, 25 to 40 compared to about 20 eggs. Overwintering sites for hibernating larvae include the boles of host and non-host trees; spruce budworm larvae hibernate in the periphery on "outer shell" of the crown.

The same complex of natural factors that affect budworm populations elsewhere appear to be active in the Rockies. Perhaps the most significant factor is unfavorable weather, particularly unseasonal spring temperatures. On at least two occasions in Colorado in the 1930's and 1940's, late spring frosts were responsible for the collapse of outbreaks, and in 1969, in both Colorado and Montana, unseasonal low temperatures accompanied by snow in late June decimated budworm populations. In Montana, populations were reduced by more than 90 percent over 1/2 million acres of forests. However, by 1972, western spruce budworm populations had resurged to their pre-1969 levels.

On the Salmon National Forest in the Intermountain Region, a 300,000-acre aerial spray project was cancelled just prior to application in June, 1965, after a "hard" late spring frost decimated western spruce budworm populations. Exceptionally low winter temperatures appear to have little or no effect on overwintering larvae.

Direct Management

Most resource managers have used insecticides in western spruce budworm management. Since the early 1950's, more than eight million acres have been treated with insecticides in six of the Rocky Mountain states.

The largest programs were in 1955, 1956, and 1957, when nearly four million acres were treated in Montana and Idaho, and in 1962-1963, when more than 800,000 acres were treated in New Mexico.

In most cases in the Northern Region, the application of insecticides reduced budworm populations and provided brief respite for the forests. Nevertheless, the application of insecticide to more than three million acres of forest in the Northern Region has had little influence on the course of the general outbreak since it continues unabated.

In the Intermountain Region, forest entomologists believe that the application of DDT in 1955-1957 effectively brought the infestation to a close on the Boise and Payette National Forests. They speculate that, had no spraying been done, the infestation would have spread throughout the grand fir habitat types on those two Forests, as had earlier outbreaks.

States	No. Acres Treated	Years
Montana	3,280,000	1952-1979
Idaho	3,098,000	1953-1979
Wyoming	127,000	1953-1957
Colorado	93,000	1962-1963
Arizona	200,000	1958-1963
New Mexico	1,400,000	1950-1966

Although insecticide treatments have an important role in budworm management, most resource managers in the Rockies have decided against their use at the present time. In the Northern Region, some managers feel that, because spraying has not changed the course of outbreaks in the past 30 years, further spraying would only be a temporary "solution" and would not prevent future cyclic buildups. Others are concerned about the high cost of spray programs, especially compared to the return on the investment in protecting the resource. And some feel that is a lack of demonstrable resource losses.

Similarly in the Intermountain Region, managers feel that spraying would only be a temporary solution and would not prevent future cyclic buildups. They feel that spraying may commit them in the future to similar suppression efforts and dollar allocation. They are also concerned that, despite their efforts, they could expect no more than a 90 percent population reduction since wildlife, fishery, stream and private land exclusions would provide additional sources for buildup. In addition, 31 percent of the infested forests in this Region are old growth stands where spraying would be of little benefit.

In essence, then, National Forest resource managers in these two Regions are willing to accept the budworm damage and impact at the present time. However, they have not ruled out use of chemical insecticides as a future option if conditions change, or for use on high-value areas such as seed orchards and recreation sites.

Indirect Management

As an alternative to the use of insecticides, many resource managers in the Northern and Intermountain Regions have opted for "silvicultural treatment" in many budworm-infested stands. This management option is somewhat intuitive, since little information exists and few studies have been made to relate the effects of silvicultural practices or stand manipulations on the behavior or impact of western spruce budworm in the Rockies.

In the Northern Region, the "special silvicultural treatments" are defined as logging, thinning and other practices that alter stand composition or structure. Efforts are being made to (1) harvest dead and severely damaged trees (sanitation salvage) from accessible stands; (2) remove top-killed trees incapable of recovery from accessible stands; (3) encourage diversity of species and age classes; and (4) favor intolerant species, single-storied stands and even-aged management.

In the Intermountain Region, the management plan is to accelerate harvest on National Forest lands yielding high rate of return on grand fir. This accelerated harvest program is designed to provide a species mix felt to be generally less vulnerable (probability of mortality once forests infested) to damage, such as ponderosa and lodgepole pine, western larch, and Douglas-fir. Managers in this Region feel that stand conversions to mixed species are more acceptable to the public than the use of chemicals insecticides, and that diversified stands are much more desirable in terms of major impact by single insect or disease infestations.

Indirect management of the western spruce budworm, whether it be intuitive, as currently practiced, or based on future detailed studies of the forest and the insect, does have some drawbacks. The species conversion or other manipulation of stands is a gradual process, and on some sites is not practicable. Silvicultural practices are restricted to managed forests; this excludes forest preserves, some influence zones, RARE II (Roadless Area Review Evaluation) areas, and other sites where managed and unmanaged forests are interspersed.

Managers do not expect that indirect management practices, any more than direct management, will "control" or "eliminate" the western spruce budworm. Nor do they feel that silvicultural practices will necessarily minimize the susceptibility (probability of forests being infested) of Rocky Mountain forests. However, sound silvicultural treatments can be designed which will minimize tree and stand vulnerability and effectively reduce the impact of the western spruce budworm. The major research effort in the Northern Rockies, as part of the western component of the CANUSA Program, is directed with that hypothesis in mind.

David G. Fellin — Intermountain Forest and Range Experiment Station, Missoula, Montana.

CANUSA-West Working Group Meetings

Western working group meetings were held in Portland, Oregon, during the week of October 22-26, at the Imperial Hotel. Turnout was excellent with 40-55 attending each session. Visitors included Frank Webb from New Brunswick, Canada, Robert Lyon, and John Neisess from Washington.

Although data were still in early stages of analysis, major accomplishments were evident in many areas. After describing work in progress, the survey and evaluation group reviewed the survey needs of western land managers, and discussed available or needed data for evaluation of new sampling procedures. The insect dynamics working group reviewed work in progress, including development of a conceptual western spruce budworm population dynamics model. The stand dynamics and impacts working groups used the format of an environmental impact statement to focus attention on studies in these areas and to point out needs for further research. The control working group discussed work in progress on chemical and microbial insecticides and application technology, and continued with discussion on direction and priorities in control research. Field testing of B.t. was ranked highest, followed by means for protecting special areas (seed trees, orchards, nurseries, shade trees, campgrounds) with microbial and chemical sprays or implants.

Special meetings were held: (1) to initiate plans for insect dynamics model workshop, (2) to decide when B.t. should be pilot tested in the west, and (3) to develop plans to explore data bases containing long-term records of budworm populations.

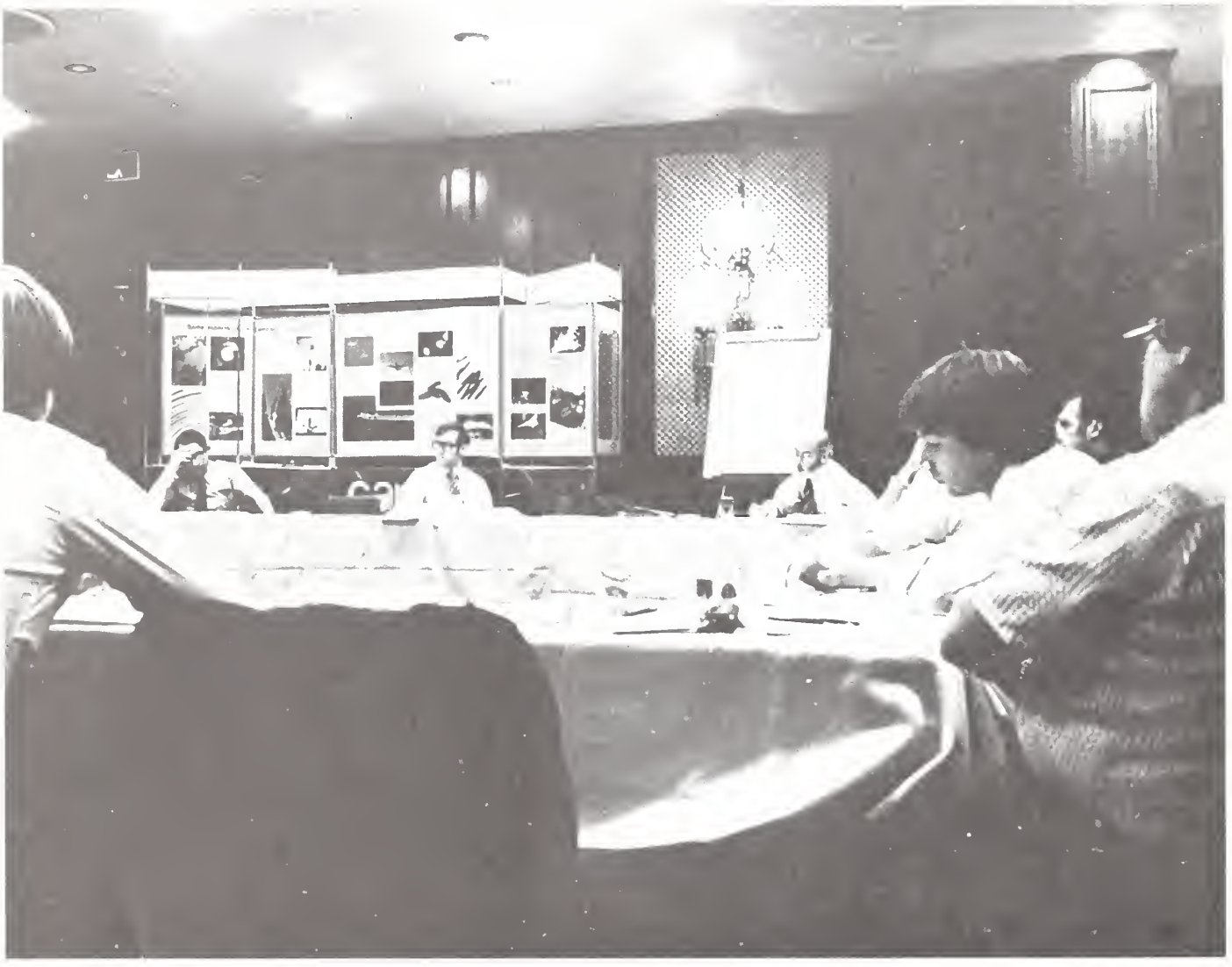


Figure 2. CANUSA – East working group meeting in session at Toronto. CFS CANUSA display in background.

Recommendations provided to Program Management through interactive discussions at these sessions will help to identify research gaps, to redirect some lines of research, and to eliminate others. All in all, it was a stimulating and informative week of meetings.

CANUSA-East Working Group Meetings

Approximately 120 budworm scientists, managers and administrators attended the second annual CANUSA-East working group meetings at the Sutton Place Hotel, Toronto, from October 29 to November 2.

Studies in progress were reviewed and discussed, research needs were evaluated and recommendations were made on research priorities. The meeting featured eight formal sessions (six of which were held concurrently), as well as a number of "special interest" meetings. At the conclusion the co-chairmen presented a synopsis of their sessions to the Operating Committee. Subjects ranged from population processes, stand dynamics, modelling, economics, treatments and environmental concerns to specific topics such as how to use B.t. and pheromones. The Demonstration Committee also met during the sessions in order to identify appropriate demonstration projects.

The details of various working group conclusions will be reported in subsequent newsletters.

CANUSA Display

Bruce Denyer reports the construction of a CANUSA display, assembled by CFS in time for the CIF Meeting in Jasper. The display consists of photos and equipment, provided by the various regional establishments, mounted on a series of panels. Text, in French and English, was edited by Bonnie Baird and Marcel Therrien. Lin Wong was the design artist.

In addition to the Jasper meeting, the display appeared at the SAF Convention in Boston, the Forum meetings in Ottawa and the eastern working group meetings in Toronto. Currently it is "doing the rounds" in various government buildings in Ottawa.

Plans are to move it to various locations in Canada and the United States over the coming year. Watch for it in your area.

The Press Say:

New Brunswick's spruce budworm program was "moderately successful in 1979, but the insects defoliated 1.5 million more acres this year than in 1978, largely in populated, unprotected areas," a federal forestry official says.

Ed Kettela, a forestry officer with the Maritimes Forest Research Centre branch of Environment Canada, said recently the budworm egg mass count and the forecasted infestation for 1980 are down, but the bad news is that total defoliation in New Brunswick increased from two million acres in 1978 to 3.5 million acres in 1979.

(Halifax Chronicle Herald, September 29, 1979)

New Brunswick will intensify its pilot spruce budworm spray program next year in areas within a mile of occupied houses, Natural Resources Minister J.W. Bird said recently.

"Almost the entire area within the one-mile setback zones is subject to some kind of hazard and 30 per cent of our total forest production is concentrated in those areas," Mr. Bird said.

(Globe and Mail, September 29, 1979)

The spruce budworm attack on Nova Scotia forests continued in 1979 bringing the area defoliated to 2.7 million acres, compared with 1.9 million acres last year. However, the province carried out a fairly successful program over 20,600 acres to control the pest with a biological experiment using a bacterial agent known as B.t.

Lands and Forests Minister George Henley said recently, the B.t. results will encourage the government to consider using B.t. for foliage protection "in selected areas on a limited basis next year."

He is worried though about the cost of B.t. spraying, comparing the cost of $19 an acre with New Brunswick insecticide spray costing about $3 an acre.

(Halifax Chronicle Herald, October 11, 1979)

"Because of the age class, present condition of the forest and the difficulty in controlling the budworm, we could have a serious wood shortage facing us by the year 2000," said H.J. O'Neill, President of the C.F.A. of New Brunswick, recently. During the period 2000-2020, there will be a reduction in the present harvest of spruce and fir up to 50 per cent, depending upon the budworm.

Mills have two choices in the year 2000. One is closure or reduction to 50 per cent capacity. The other is to convert mills, as much as possible, to use species presently under-utilized. In any event, government planning should recognize this inevitable shortage and the resultant unemployment.

(Halifax Chronicle Herald, October 17, 1979)

Nonylphenol Again

Errol Caldwell, Pesticide Evaluation Officer with Agriculture Canada, reports the second meeting on this subject within six months. Nonylphenol, you may recall, is a solvent used in Matacil formulations in eastern Canada, and has been questioned because of its known toxicity to fish. After careful review by officers from Fisheries and Oceans, Agriculture Canada, Health and Welfare, Canadian Forestry Service, and private investigators, it was concluded that the concentrations to be expected in aquatic environments following normal operational treatments would be far below the toxic levels for fish and other aquatic organisms. Continued research was recommended to further define the toxic limits. No further meetings are planned.

Conferences

An "Insect Rearing Conference," scheduled for March 4-6, 1980 at Atlanta, Georgia, is USDA-sponsored but with a scope of Federal, State, University, and commercial interest. International participants are welcomed. For more information, contact Dr. R.F. Moore, Conference Coordinator, USDA-SEA, Agricultural Research, Cotton Insects Research, Post Office Box 271, Florence, South Carolina 29505. (From Ent. Soc. Canada BULLETIN).

A Symposium on "Estimating Populations of Terrestrial Birds" will be held October 2-3, 1980 at the Asilomar Conference Grounds near Monterey, California, cosponsored by the Pacific Southwest Forest and Range Experiment Station and the U.S. Fish and Wildlife Service. The conference will cover methods for estimating populations, designs for censuses and sampling, collection and analysis of data, biases and other potential sources of error, and special problems associated with estimating certain species. Copies of the preliminary schedule are available from C.J. Ralph at the Institute of Pacific Islands Forestry, 1151 Punchbowl St., Rm. 323, Honolulu, Hawaii 96813 (From PSW Newsletter.)

A national Symposium on Hazard Rating Systems in Forest Insect Pest Management will be held at Athens, Georgia, July 31 to August 2, 1980. The event is sponsored by the Society of American Foresters, the USDA Forest Service, and the University of Georgia.

The theme will be the development and use of stand susceptibility rating systems for insect pests of North American forests. The aims of the symposium are: (1) to identify hazard and risk ratings methods in use in North America and land manager experience with them; (2) to investigate methods for developing, validating, and implementing rating systems; and (3) to identify where additional needs exist to improve the utility of rating systems.

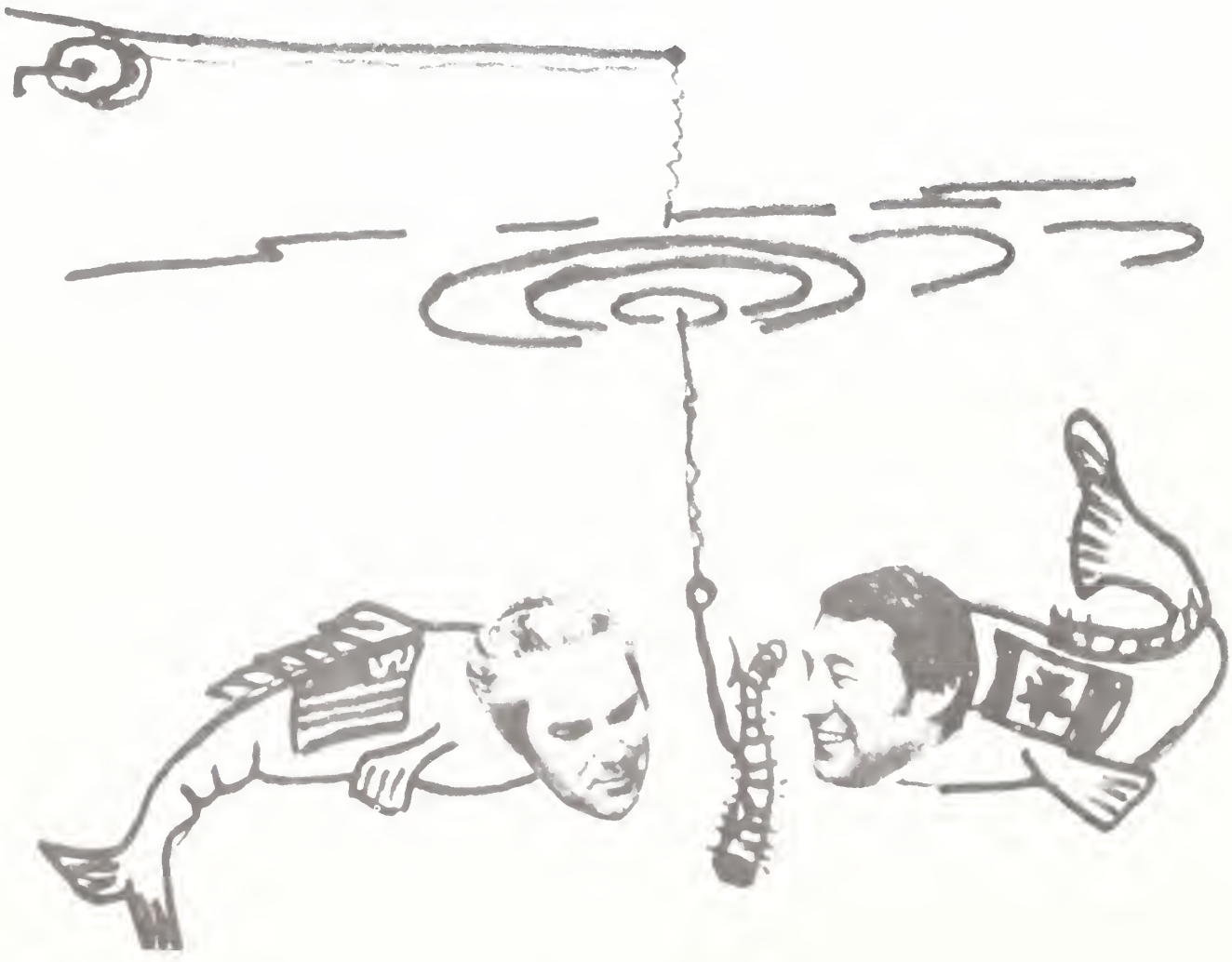
Areas of particular interest are general approaches to development of rating systems, limitations of systems, problems in applying systems during low insect population level periods, systems for rating stand and tree susceptibility to bark beetles, defoliators, scales, root feeders, leaf miners, etc., and incorporation of rating systems into integrated forest management plans. Presentations of contributed papers will be limited to 20 minutes with 10-minute discussions. Papers are welcomed and proceedings will be published.

Abstracts for contributed papers will be accepted for review until February 1, 1980. Submit 200-word reviewers abstracts and title to:

Dr. Roy L. Hedden, Program Chairman
College of Forest and Recreation Resources
Department of Forestry
Clemson University
Clemson, SC 29631

Forest Pest Control Forum

The spruce budworm occupied the lion's share of discussion as 65 research managers, resource managers and senior scientists gathered in Ottawa, November 27-28 to review the status of forest pests during 1979 and to forecast the prospects for 1980. Although budworm populations in eastern North America are down somewhat from previous years, there appears to be no significant relief in sight as managers prepare for yet another major control program in 1980. Fenitrothion, Aminocarb and B.t. appear to be the materials most likely to be used again in '80. Public concern for the health implications of control operations once again presented a high profile during the 1979 operational season. As a measure of public education, the Province of Ontario mounted a major public relations program including the booklet "In answer to your concerns about aerial spraying in Northern Ontario forests," either in your hands already or inserted with this issue of the Newsletter. The 1980 meeting is scheduled for the Sussex Room of the Convention Centre opposite the Chateau Laurier Hotel, Ottawa, November 18, 19 and 20.



Publications and Reports

"Demonstration of Marsh Turbo Thrush to Deliver Pesticides to Coniferous Forests, Phase 2 — Forest Spraying" by John W. Barry et al. Ask for Report 79-2 from Methods Application Group, Forest Insect and Disease Management, USDA, Forest Service, 2810 Chiles Road, Davis, California 95616.

Now available — "Effects of Aerially Applied Mexacarbate on Western Spruce Budworm Larvae and their Parasites in Montana," by Carroll B. Williams, Jr., Patrick J. Shea, and Mark D. McGregor. Ask for Research Paper PSW-144 from Pacific Southwest Forest and Range Experiment Station, P.O. Box 245, Berkeley, California 94701.

From the Newfoundland Forest Research Centre, P.O. Box 6028, St. John's, Newfoundland, A1C 5X8, Reports N-X-170, edited by J. Munro on economic impact, N-X-171 by B. Moody and S. Otvos on the status of the insect, N-X-173 by Moody again, concerning damage assessment and the Proceedings of a symposium, edited by J. Richardson, dealing with the future of fir.

The Maritimes Forest Research Centre, P.O. Box 4000, Fredericton, N.B., E3B 5P7, announces Report M-X-102 by Baskerville and MacLean, regarding tree mortality and recovery.

The Forest Pest Management Institute, P.O. Box 490, Sault Ste. Marie, Ontario, P6A 5M7, has issued Reports FPM-X-15 by B. Arif and P. Dobos, regarding the cellular activity of viruses; FPM-X-21 by J. Cunningham et al., concerning aerial application of virus formulations; and FPM-X-16 by C. Edwards, evaluating the potential of helicopters.

Additional Awards for 1979 Spruce Budworms Research

The following individuals and institutions or agencies have been approved for funding by CANUSA-West:

Study Title	Principal Investigators
Budworm generation survival	J. Wayne Brewer John L. Capinera Jesse A. Logan Colo. St. Univ.
Dispersal mechanisms in western coniferous forest systems.	Donald G. Burnell Univ. of Idaho
Joint action of a juvenile hormone analog and selected molt disruptants.	Jeffrey Granett (with J. Robertson & A. Retnakaran)
Distribution, sampling and mortality factors of the overwintering stage.	Tom Egan J.A. Rudinski